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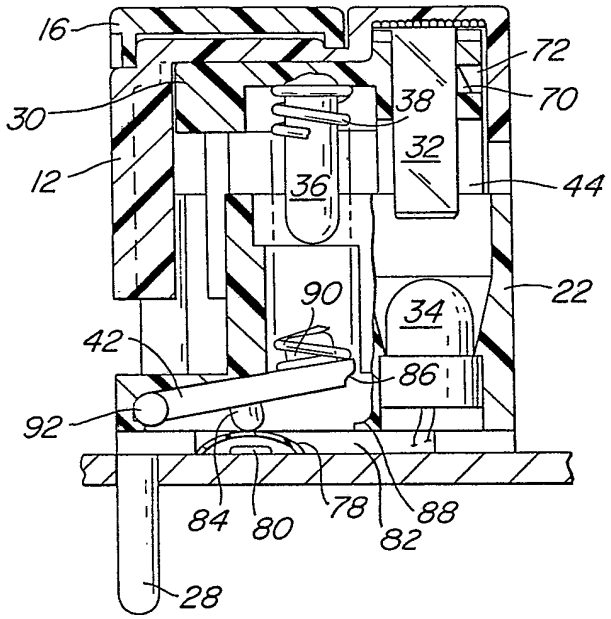
(54) Long-stroke push-button switch.

(57) A long-stroke push-button switch has contacts which close in the middle of the travel and remain closed through the last half of the travel. The switch has a keytop (12) and a lever (42) interconnected by a stiff spring (38). One end of the lever is pivotably mounted (at 92) in the switch housing. A downwardly projecting actuator (84) located on the underside of the lever rests upon the top of a normally-open snap-dome switch (78, 80). The axis of the snap-dome switch is located off-centre with respect to the centre line of the keytop. When the keytop (12) is depressed, the spring (38) is compressed during the first half of the keytop travel. When the spring is partially compressed, further pressure on the keytop causes the lever (42) to pivot and close the snap-dome switch contacts (78, 80) in the middle of the travel. Continued pressure on the keytop (12) further compresses the spring and allows the keytop to move through the last half of the travel after the contacts have closed.



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LONG-STROKE PUSH-BUTTON SWITCH

The present invention relates to push-button switches, and in particular long-stroke switches which can be used in a group, such as a keyboard, or individually as a discrete stand-alone switch.

A long-stroke switch is understood by industrial convention to have a travel of 2.28mm (0.090 inch) or more, as opposed to short-stroke and medium-stroke switches, which have a travel of 0.5mm (0.020 inch) or less and between 0.5mm and 1.5mm (0.020 and 0.060 inch), respectively. Short-stroke switches offer only limited perceived movement to the user. That is, it is often difficult for the user to "feel" that the switch has moved. Long-stroke switches, on the other hand, provide excellent tactile response and "feel".

A need exists for a long-stroke push-button switch with contacts which close in the middle of the travel and remain closed through the last half of the travel. such a switch should also be capable of being easily illuminated.

A long-stroke switch can be constructed using a lever and spring arrangement. The lever in effect moves the centre line of the actuator to allow a short-

travel switch contact to be located to one side of the centre line of the long-travel keytop. A spring is used to cause the short-travel contact to close at the centre of the travel of the keytop. Use of a lever also allows indicator lamps to be mounted close to the centre of travel, permitting closer centre-to-centre spacing between the lamp and the centre of the switch. Using a short-travel switch contact permits the height of the long-travel switch assembly to be reduced to a minimum while maintaining the long stroke.

The present invention provides a long-stroke push-button switch assembly. The switch assembly comprises a housing supported on a base and depressible key means operatively associated with the housing and arranged for reciprocable travel relative to the housing. Normally-open short-stroke contact means are provided below the base, with the axis of movement of the contact means being parallel to but spaced from the axis of movement of the key means. A lever means is pivotably mounted relative to the housing and operatively associated with the contact means for closing the contact means when the key means is depressed. A spring means interconnects the key means and the lever means. The spring means has a stiffness sufficient to overcome the resistance of the contact means so as to cause the lever means to pivot and close the contact means when the key means is at approximately the midpoint of its travel, but also has a resilience sufficient to allow the key means to complete the last half of the travel after the contacts have been closed.

In order that the invention shall be fully understood, one preferred embodiment of switch in accordance with the invention will now be described by way of example and with reference to the accompanying drawings. In the drawings:

Figure 1 is a perspective view of a switch assembly in accordance with the present invention.

Figure 2 is an exploded view of the switch assembly shown in Figure 1, showing the interrelationship of the individual parts.

Figure 3 is a sectional view taken along the line 3-3 of Figure 1.

Figure 4 is a sectional view taken along the line 4-4 of Figure 3.

Figure 5 is a sectional view taken along the line 5-5 of Figure 3, showing the switch in the normally-open position.

Figure 6 is a sectional view taken along the line 5-5 of Figure 3, showing the switch in the fully-depressed position.

Referring now to the drawings, wherein like numerals indicate like elements, there is shown in Figure 1 a long-stroke push-button switch assembly 10 in accordance with the present invention. The switch 10 includes a keytop 12 actuated by the user's finger. The keytop 12 may be made of a clear or translucent polycarbonate material. The keytop 12 has a legend area 14 surmounted by a legend cap 16. The legend cap 16 is preferably made of a clear acrylic material. The legend surface 14 may be used to display a graphic or printed legend to the user. The legend cap 16 snap fits on to the keytop 12 via a pair of mating structures comprising a recess 18 in the keytop 12 and a projection 20 on the inner surface of the legend cap 16, see Figure 2.

The keytop 12 is arranged for reciprocal travel relative to a housing 22. As best seen in Figures 2 to 4, the keytop 12 is substantially in the shape of an inverted hollow cube open at one end. The keytop 12 thus fits over the housing 22, and moves reciprocally

with respect to the housing.

The switch 10 further comprises the housing 22 which includes a base 24. Integral with the base 24 are a plurality of feet 26 which rest on the surface of a printed circuit board. Two locating pins 28 depend downwardly beneath diagonally opposite feet 26 and serve to locate and attach the switch 10 in proper registry with a mounting surface.

As best seen in Figure 2, the switch 10 includes an insert 30 located within the keytop 12. The insert 30 carries two light pipes 32 which serve to conduct light from an illuminating lamp or lamps 34 (see Figures 5 and 6) to the keytop 12. The light pipes 32 are preferably made of the same clear acrylic material from which the legend cap is made. The insert 30 has a downwardly projecting post 36 which secures one end of a coil spring 38. The other end of the coil spring 38 is secured in a cavity 40 within the housing 22. A lever 42 is pivotably mounted at one end in the housing 22, see Figures 5 and 6. The illuminating lamps 34 are located within respective cavities 44 in the housing 22.

The keytop 12 is retained on the housing 22 by retaining pawls 46 and 48, see Figure 4. The retaining pawls 46 and 48 have stops 50 and 52 respectively, which extend into openings 54 and 56 in the keytop 12. The retaining pawls 46 and 48 are resilient enough so that the keytop 12 can simply be snapped on to the housing 22. The stops 50 and 52 limit upward movement of the keytop 12. Downward movement of the keytop 12 is limited by contact between the sides of the keytop 12 and the top of the base 24. The keytop 12 has a plurality of internal ribs 58,60 and 62 which mate with elongated slots 64,66 and 68 in the housing 22. The ribs and slots serve as guides to constrain movement of the keytop 12 to linear reciprocal movement.

As best seen in Figures 5 and 6, the light pipes 32 are each retained in the insert 30 by a retaining finger 70, which snaps into an opening 72 in the insert 30. Each light pipe 32 extends downwardly through the cavity 44 in the insert 30 and is substantially coaxial with its lamp 34. A pair of leads 74 supply electric current to the lamp 34.

Figures 5 and 6 show the switch 10 mounted on a printed circuit board 76. PC board 76 is provided with openings (not numbered) for receiving the locating pins 28. The locating pins 28 serve properly to position the switch 10 over the normally open switch contacts. The switch contacts may comprise any short-stroke set of contacts, such as snap-dome, membrane or other short-stroke contacts. For the purpose of illustrating this preferred embodiment of the invention, the switch 10 is shown with short-stroke contacts in the form of a snap-dome 78 and a printed contact 80 on PC board 76. Snap-dome switches are well-known and need not be described in detail here. The feet 26 space the switch 10 above the PC board 76, and define a space 82 surrounding the switch contacts 78 and 80.

The lever 42 has a downwardly-projecting actuator 84 which rests lightly upon the snap-dome contact 78 when the switch 10 is in the normally-open position, as shown in Figure 5. The lever 42 is provided with a stop surface 86 which coacts with a stop surface 88 in the housing 22 to limit downward movement of the lever 42 when the switch 10 is depressed. The lever 42 also has a short post 90 on its upper surface to position the lower end of the spring 38. Trunnions 92 pivotably secure the lever 42 to the housing 22.

The operation of the switch will now be described with particular reference to Figures 5 and 6. Figure 5 is a sectional elevation of the switch in the

normally-open position. The spring 38 is mildly compressed and the keytop 12 is urged by the spring 38 to its highest position. The snap-dome 78 is in the normally-open position, and supports the lever 42 via the lever actuator 84 at a position inclined slightly above the horizontal.

As the keytop 12 is depressed, the spring 38 is compressed further. The spring 38 is stiff enough so that, when the keytop 12 is at approximately the midpoint of its travel, the spring 38 is only partially compressed and the force with which the keytop 12 is depressed is transmitted through the spring 38 to the lever 42. The mechanical resistance of the snap-dome contact 78 is overcome by the force depressing the keytop 12, and the lever 42 pivots clockwise as viewed in Figure 5 and presses the snap-dome contact 78 down to bring it into contact with the printed contact 80, thereby closing the switch contacts.

Further pressure on the keytop 12 continues to compress the spring 38 until the spring is still further compressed, as shown in Figure 6. Thus, the keytop 12 continues to move downward under finger pressure after the contacts 78 and 80 have been closed. When the downward pressure on the keytop 12 is released, the spring 38 expands, returning the keytop 12 to its initial position, allowing the lever 42 to pivot counter-clockwise as viewed in Figure 5. As the lever 42 pivots counter-clockwise, the snap-dome contact 78, because of its inherent resilience, returns to the normally-open position.

It will be appreciated that the switch of the present invention achieves the objects set forth above in a unique and non-obvious manner.

It will also be appreciated that the present invention can be used easily to convert any conventional

short-stroke switch into a long-stroke switch by locating the switch 10 over any conventional short-stroke switch.

CLAIMS

1. A long-stroke push-button switch assembly, comprising:

(a) a housing (22) supported on a base (24),

(b) depressible key means (12) operatively associated with the housing and arranged for reciprocable travel relative thereto,

(c) normally-open short-stroke contact means (78,80) below the base (24), the axis of movement of the contact means being parallel to but spaced from the axis of movement of the key means,

(d) lever means (42) pivotably mounted relative to the housing and operatively associated with the contact means for closing the contact means (78,80) when the key means (12) is depressed, and

(e) spring means (38) interconnecting the key means (12) and the lever means (42), the spring means having a stiffness sufficient to overcome the resistance of the contact means so as to cause the lever means to pivot and close the contact means when the key means is at approximately the midpoint of its travel but having a resilience sufficient to allow the key means to complete the last half of the travel after the contacts have been closed.

2. A switch according to claim 1, characterised by means (34,32) for illuminating the key means (12) after the switch contact means (78,80) have been closed.

3. A switch according to claim 1 or 2, characterised by means (14) for displaying a legend on its upper surface.

4. A switch according to claim 1, 2 or 3, characterised in that said housing (22) includes a plurality of spacer means (26) integral with the base (24) for locating the base a fixed distance above the contact means.

5. A switch according to claim 4, characterised by further means (28) integral with the base (24) for locating and mounting the switch in registry with a switch mounting surface.

6. A switch according to claim 5, characterised in that said locating and mounting means comprise downwardly projecting pins (28) on at least two of the spaced means (26).

7. A switch according to any preceding claim, characterised in that the spring means comprises a cylindrical coil spring (38).

8. A switch according to any preceding claim, characterised in that the contact means comprise a snap-dome switch (78,80).

9. A switch according to any of claims 1 to 7, characterised in that the contact means comprise a membrane switch.

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FIG. 1

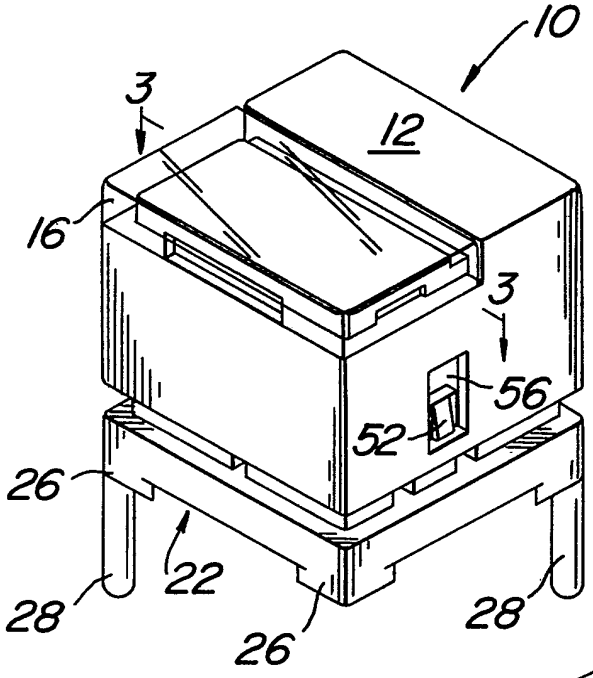
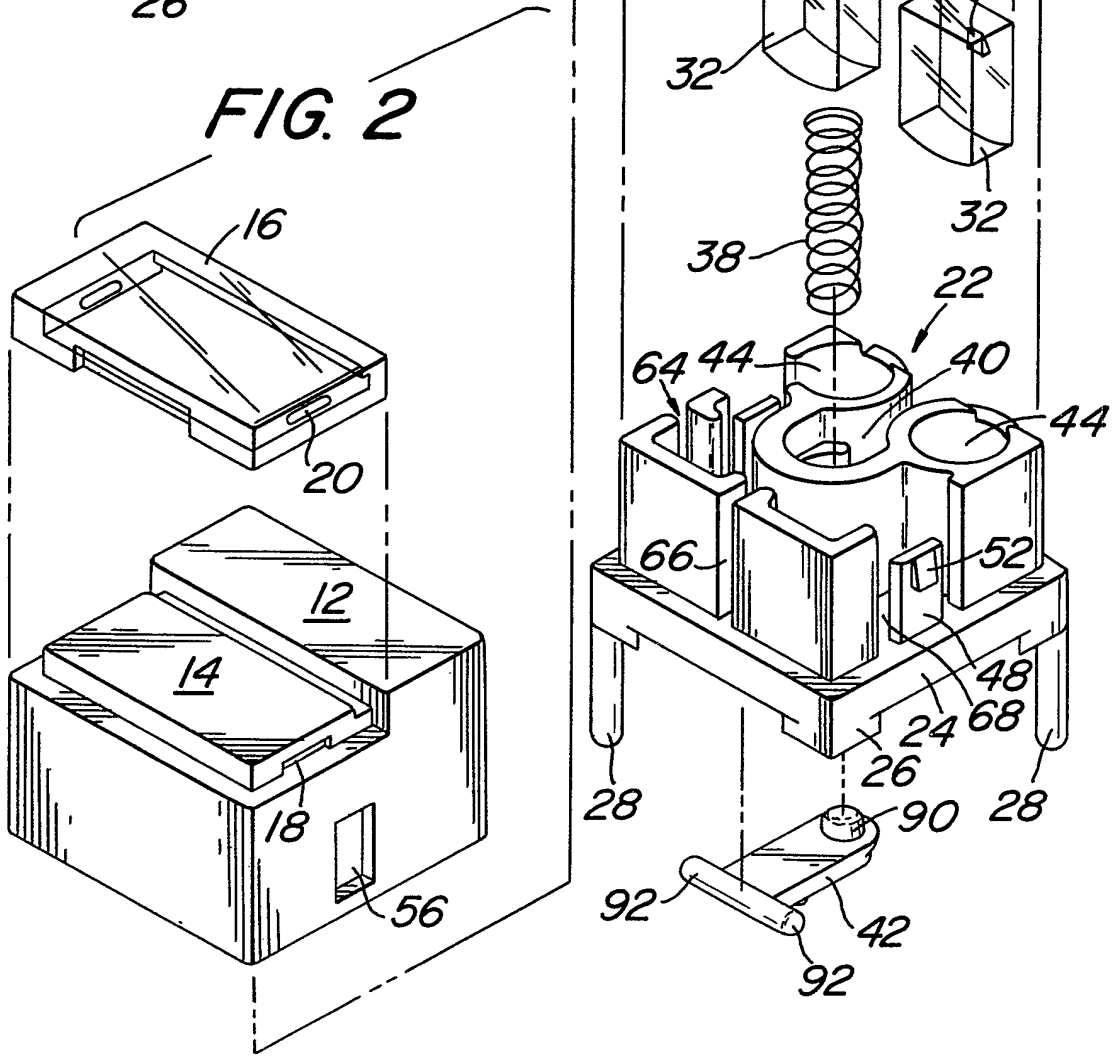


FIG. 2



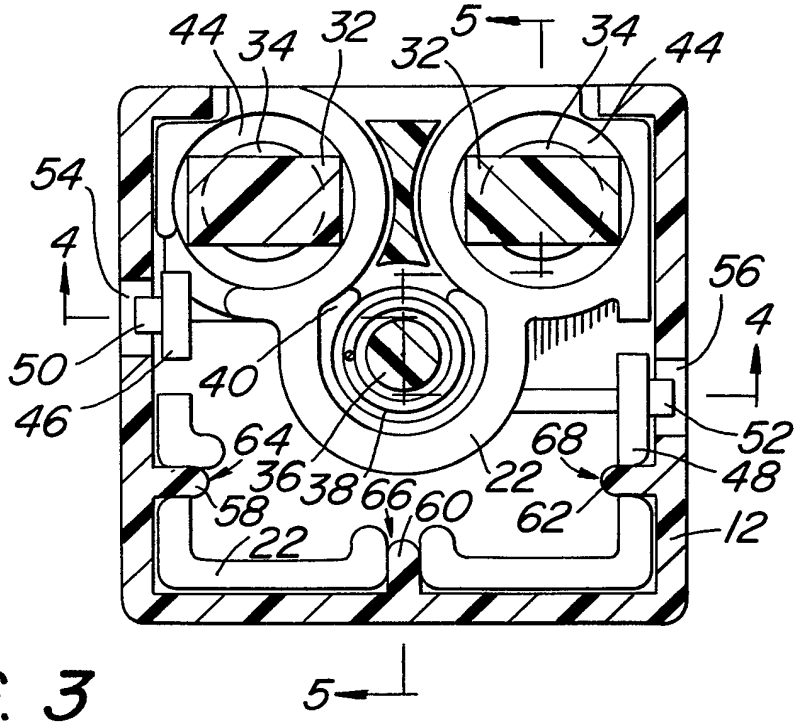

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FIG. 3

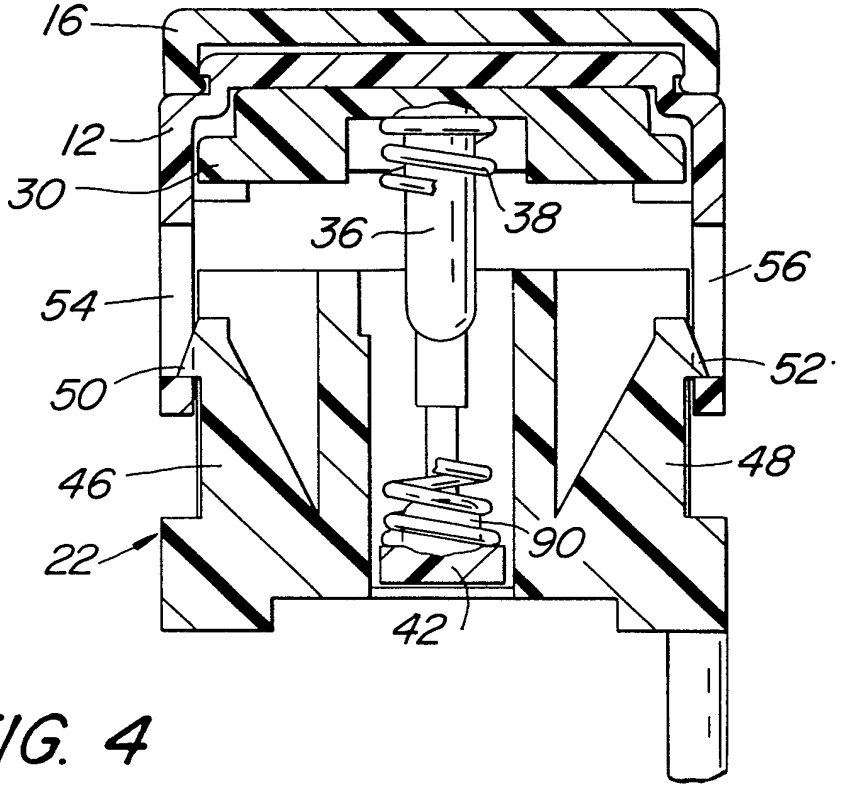
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FIG. 4

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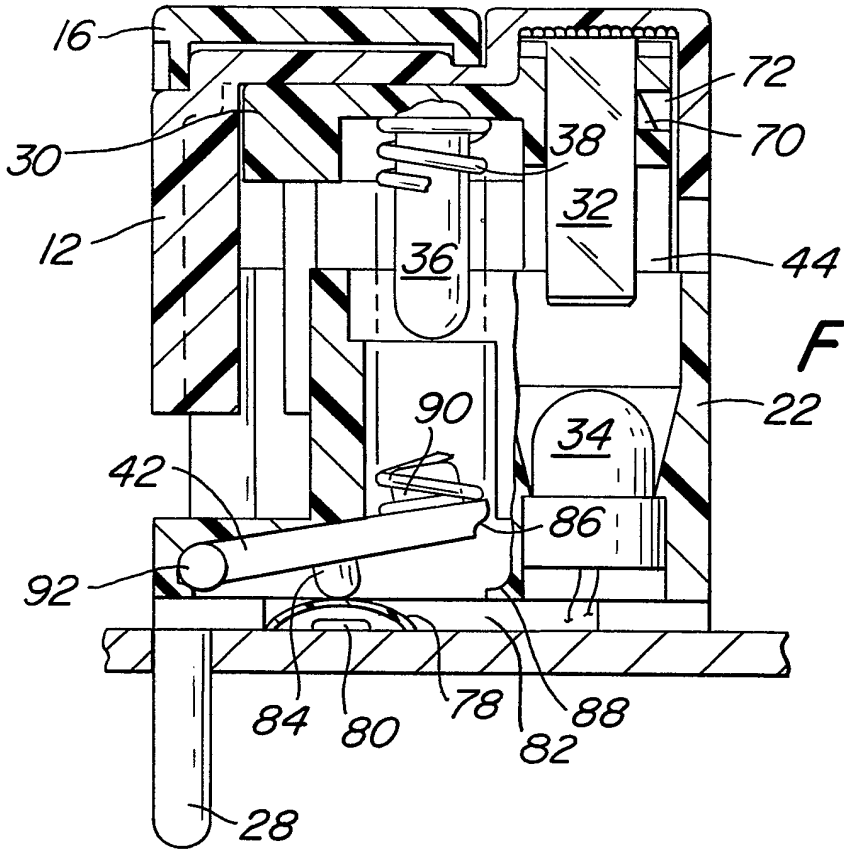

FIG. 5

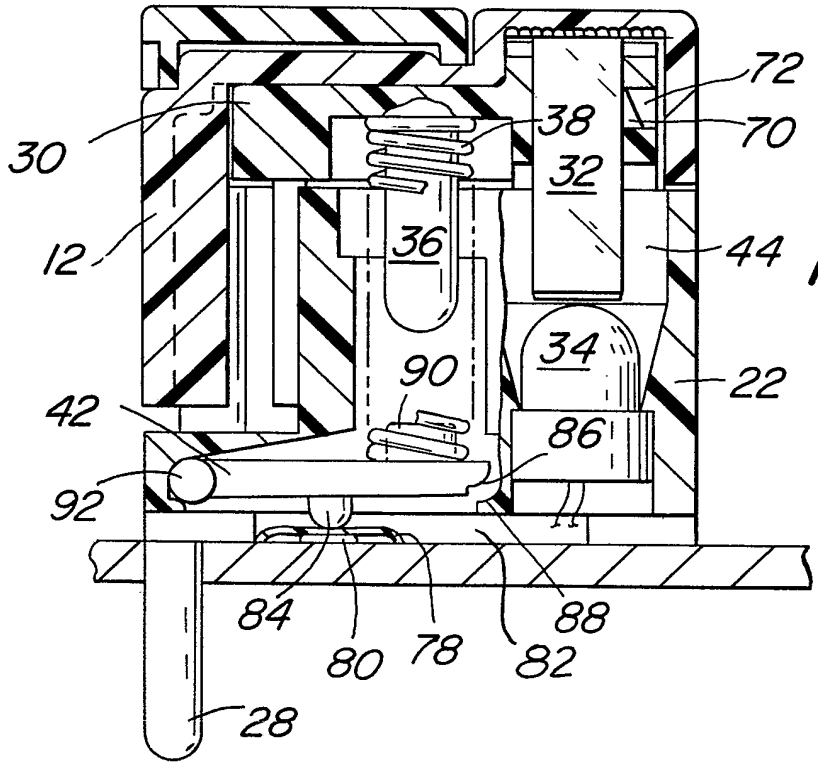

FIG. 6

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ASSIGNEE-INFORMATION:

NAME	COUNTRY
BOWMAR INSTRUMENT CORP	US

APPL-NO: EP84306247
APPL-DATE: September 12, 1984

PRIORITY-DATA: US59449284A (March 29, 1984)

INT-CL (IPC): H01H013/02 , H01H013/70

EUR-CL (EPC): H01H013/705

US-CL-CURRENT: 200/329

ABSTRACT:

CHG DATE=19990617 STATUS=O> A long-stroke push-button switch has contacts which close in the

middle of the travel and remain closed through the last half of the travel. The switch has a keytop (12) and a lever (42) interconnected by a stiff spring (38). One end of the lever is pivotably mounted (at 92) in the switch housing. A downwardly projecting actuator (84) located on the underside of the lever rests upon the top of a normally-open snap-dome switch (78, 80). The axis of the snap-dome switch is located off-centre with respect to the centre line of the keytop. When the keytop (12) is depressed, the spring (38) is compressed during the first halt of the keytop travel. When the spring is partially compressed, further pressure on the keytop causes the lever (42) to pivot and close the snap-dome switch contacts (78, 80) in the middle of the travel. Continued pressure on the keytop (12) further compresses the spring and allows the keytop to move through the last half of the travel after the contacts have closed.